CLAIMS

We claim:

1. A method of customizing a polishing pad for chemical mechanical planarization of a substrate, the method comprising:

obtaining one or more characteristics of a structure on a substrate; and

selecting a value for one or more chemical or physical properties for a pad to be used in chemical mechanical planarization of the substrate based on the obtained one or more characteristics of the structures on the substrate.

2. The method of claim 1, wherein the one or more characteristics of a structure includes a size of the structure.

3. The method of claim 1, wherein the one or more characteristics of a structure includes a pattern density of the structure.

4. The method of claim 1, wherein the one or more characteristics of a structure includes film material and a number of different materials.

5. The method of claim 1, wherein one or more chemical or physical properties for the pad includes hardness, thickness, surface grooving, porosity, thickness, Youngs modulus, compressibility, or asperity of the pad.

6. The method of claim 1, wherein selecting a value for one or more chemical or physical properties for a pad comprises:

performing a simulation of planarization of the substrate with a model of a CMP process using the pad with a range of values for the one or more chemical or physical properties of the pad; and

selecting a value for the one or more chemical or physical properties based on the simulation.

7. The method of claim 6, further comprising:

providing a pattern density and a deposition bias as inputs to the model of a CMP process.

8. The method of claim 6, further comprising:

obtaining a planarization length from the model of a CMP process; and

performing a sensitivity analysis to determine a correlation between planarization length and the one or more chemical or physical properties of the pad.

9. The method of claim 8, wherein the value for the one or more chemical or physical properties is selected based on the determined correlation between planarization length and the one or more chemical or physical properties of the pad to optimize planarization length.

10. The method of claim 6, further comprising:

identifying dishing and/or erosion from the model of a CMP process; and

performing a sensitivity analysis to determine a correlation between the one or more chemical or physical properties of the pad and dishing and/or erosion.

11. The method of claim 10, wherein the value for the one or more chemical or physical properties is selected based on the determined correlation between the one or more chemical or physical properties of the pad and dishing and/or erosion to reduce dishing and/or erosion.

12. The method of claim 6, further comprising:

identifying over-polishing and/or under-polishing from the model of a CMP process; and

performing a sensitivity analysis to determine a correlation between the one or more chemical or physical properties of the pad and over-polishing and/or under-polishing.

13. The method of claim 12, wherein the value for the one or more chemical or physical properties is selected based on the determined correlation between the one or more chemical or physical properties of the pad and over-polishing and/or under-polishing to reduce over-polishing and/or under-polishing.

14. The method of claim 1, wherein the structure is an optoelectronic device.

15. The method of claim 1, wherein the substrate is a magnetic disk, an optical disk, a ceramic substrate, or a nano-composite substrate.

16. A method of customizing a polishing pad for chemical mechanical planarization of a semiconductor wafer, the method comprising:

obtaining one or more characteristics of a chip;

performing a simulation of a chemical mechanical planarization of the wafer with a model of a CMP process using the obtained one or more characteristics of the chip and a range of values for the one or more chemical or physical properties of the pad; and

selecting a value for one or more chemical or physical properties for a pad based on the simulation.

17. The method of claim 16, wherein the one or more characteristics of the chip includes a pattern density of the chip.

18. The method of claim 17, wherein one or more chemical or physical properties for the pad includes hardness, thickness, surface grooving, porosity, thickness, Youngs modulus, compressibility, or asperity of the pad.

19. The method of claim 16, further comprising:

obtaining a planarization length from the model of a CMP process; and

performing a sensitivity analysis to determine a correlation between planarization length and the one or more chemical or physical properties of the pad.

20. The method of claim 19, wherein the value for the one or more chemical or physical properties is selected based on the determined correlation between planarization length and the one or more chemical or physical properties of the pad to optimize planarization length.

21. The method of claim 16, further comprising:

identifying dishing and/or erosion from the model of a CMP process; and

performing a sensitivity analysis to determine a correlation between the one or more chemical or physical properties of the pad and dishing and/or erosion.

22. The method of claim 21, wherein the value for the one or more chemical or physical properties is selected based on the determined correlation between the one or more chemical or physical properties of the pad and dishing and/or erosion to reduce dishing and/or erosion.

23. The method of claim 16, further comprising:

identifying over-polishing and/or under-polishing from the model of a CMP process; and

performing a sensitivity analysis to determine a correlation between the one or more chemical or physical properties of the pad and over-polishing and/or under-polishing.

24. The method of claim 23, wherein the value for the one or more chemical or physical properties is selected based on the determined correlation between the one or more chemical or physical properties of the pad and over-polishing and/or under-polishing to reduce over-polishing and/or under-polishing.

25. A method of customizing of tribological or material properties of a pad used in a chemical mechanical polishing (CMP) process to planarize a metal or dielectric film having varying topographic or material characteristics on a substrate, the method comprising:

compensating for pattern density effects for different chip architecture during the CMP process; and

optimizing a derived planarization length, response characteristics for dishing and/or erosion, or final step height at specific pattern features to attain local and global planarization.

26. The method of claim 25, wherein the optimization is performed during planarization of a silicon integrated circuit.

27. The method of claim 25, wherein the optimization is performed during planarization of an optoelectronic device.

28. The method of claim 25, wherein the optimization is performed during planarization of a magnetic or optical disk.

29. The method of claim 25, wherein the optimization is performed during planarization of film on a ceramic or nano-composite substrate.

30. A polishing pad for chemical mechanical planarization of a semiconductor wafer, the pad having:

one or more chemical or physical properties, wherein a value for the one or more chemical or physical properties is selected based on one or more characteristics of the chip.

31. The pad of claim 30, wherein the value for the one or more chemical or physical properties is selected by:

obtaining a pattern density of the chip;

performing a simulation of a chemical mechanical planarization of the wafer with a model of a CMP process using the obtained pattern density of the chip and a range of values for the one or more chemical or physical properties of the pad; and

selecting a value for one or more chemical or physical properties based on the simulation.